

Certification by the U.S. Environmental Protection Agency

General Information

The EPA is responsible for federal emissions certification of motor vehicles and motor vehicle engines in the United States. As we noted in the introduction, California may also grant emissions certification to vehicles and engines for use in California.

Regulations

The U.S. regulations regarding air quality are contained within Title 40 ("Protection of Environment") of the *Code of Federal Regulations* (CFR). Title 40 comprises 18 volumes, and each volume is

separated into parts for ease of reference. Title 40 is updated each July with any new regulations enacted during the previous 12 months, including changes and additions as recorded in the *Federal Register* (FR).

The regulations governing emissions certification and test procedures are contained within Part 86 ("Control of Air Pollution from New and In-Use Motor Vehicles and New and In-Use Motor Vehicle Engines: Certification and Test Procedures"), and the final rules for Part 86 as listed in the FR. This material applies to OEM vehicles, to OEM heavy-duty engines, and to aftermarket conversions.

Who to Contact

EPA Light-Duty Vehicles and Trucks

Environmental Protection Agency
Office of Mobile Sources
Vehicle Programs and Compliance Division
Vehicle Programs Group
2565 Plymouth Road
Ann Arbor, MI 48105
EPA Alternative Fuels Hotline
Telephone: (734) 668-4312
Fax: (734) 741-7869

**New Hotline numbers as of May 1998
Telephone: (734) 214-4312
Fax: (734) 214-4869

EPA Heavy-Duty Engines

Environmental Protection Agency
Office of Mobile Sources
Engine Compliance Programs Group
Mailing Address:
401 M St. S.W. (6403J)
Washington, DC 20460
Visiting Location and Courier Shipments:
501 3rd St. N.W.
Washington, DC 20001
Telephone: (202) 564-9261
Fax: (202) 565-2057

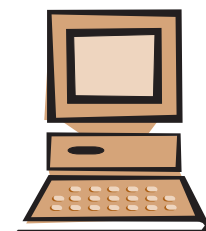


Table 1

The Parts of Title 40 of the *Code of Federal Regulations (CFR)* That Affect Certification of Aftermarket Conversions

Part	Name
85	Control of Air Pollution from Motor Vehicles and Motor Vehicle Engines
86	Control of Air Pollution from New and In-Use Motor Vehicles and New and In-Use Motor Vehicle Engines: Certification and Test Procedures
88	Clean-Fuel Vehicles
600	Fuel Economy of Motor Vehicles

The FR is an important reference source. It is the official publication for Notices, Rules, and Proposed Rules from federal agencies and organizations. As part of the regulation and rule-making process, the FR contains a preamble for the regulations. This preamble provides manufacturers with information that addresses many frequently asked questions about the regulations.

Table 1 lists the other parts of Title 40 that are key to the certification process. For example, Part 85 (or 40 CFR Part 85, as it is more technically known) contains the provisions under which parties are exempt from the tampering prohibition contained in Section 203 of the CAA (see the sidebar on page 7). Also, Part 88 contains the regulations that govern the Clean-Fuel Vehicle (CFV) and the Clean-Fuel Fleet (CFF) Program requirements.

Because the EPA updates its requirements from time to time, information presented here about the location of certain rules and regulations is also subject to change. To obtain the most up-to-date information, check with the EPA.

On October 31, 1997, just before this guide was printed, the EPA issued a draft of a number of proposed changes to 40 CFR Part 86. The changes ease the burden of certification for manufacturers of CFVs.

The title of the proposed rule is Expanded Engine Family Definition, Fee Exemption, and Revised Definition for Dedicated Fuel System for Vehicles and Engines Meeting Low-Emission Vehicle (LEV), Inherently Low-Emission Vehicle (ILEV), Ultra-Low Emission Vehicle, or Zero Emission Vehicle Exhaust Emission Standards. It is available from the EPA Office of Mobile Sources Clean Fuel Fleets World Wide Web site, listed in Appendix C.

In this document, the EPA has proposed revisions to the definition of dedicated fuel systems, adopted provisions to allow manufacturers of CFVs to group certain engine families into engine family classes, and provided for an exemption from certification fees for vehicles meeting CFV emissions standards. The revised definition of a dedicated vehicle includes vehicles capable of operating on a second (conventional) fuel for a maximum of one hour in any three-hour period, or with a total conventional fuel capacity that allows for an operational range of 50 miles. The proposed rule allows engine families to be grouped under engine family classes as defined in the document. The proposed fee exemption would be available for vehicles that certify to the EPA's LEV, ultra low-emission vehicle (ULEV), inherently low-emission vehicle (ILEV), or zero-emission vehicle (ZEV) emissions standards.

Memorandum 1A and Addendum to Memorandum 1A

As noted in the introduction, in 1974 the EPA clarified the tampering prohibition contained in Section 203 of the CAA. Memorandum 1A, or Memo 1A as it is commonly known, states, in part, that using an aftermarket part, alteration, or add-on part will not constitute tampering if the manufacturer has a reasonable basis to believe that such alterations will not adversely affect emissions performance. Through Memo 1A, the EPA outlined steps for aftermarket conversion companies to follow to arrive at this reasonable basis. The two main methods were: (1) perform emissions testing after installation, following all federal procedures to ensure that emissions were within the standards for the model year in question over the useful life of the vehicle; or (2) have a federal, state, or local environmental control agency accept that the converted vehicle's emissions performance has not been compromised. This latter provision was limited to the geographic area over which the state or local government had jurisdiction.

In an important update on September 4, 1997, the EPA released an addendum to Memo 1A, which clarifies the tampering enforcement policy and revises the terms for establishing the reasonable basis. The revised policy states "EPA will no longer accept a representation based on the pre-1994 California Procedures for alternative fuel conversion systems or on the procedures under Colorado Regulation No. 14." Three options are listed for establishing a reasonable basis:

- 1) A federal Certificate of Conformity under 40 CFR Part 86 or 40 CFR Part 88
- 2) A retrofit system certification (Executive Order) from CARB under the "California Certification and Installation Procedures for Alternative Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent

Anti-Tampering Provision of the Clean Air Act (Section 203 (a) (3))

"The following acts and the causing thereof are prohibited . . .

(3) for any person to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title prior to its sale and delivery to the ultimate purchaser, or for any person knowingly to remove or render inoperative any such device or element of design after such sale and delivery to the ultimate purchaser."

Model Years and for All Model Year Motor Vehicle Retrofit Systems Certified for Emission Reduction Credit" for a conversion system installed and tested under the above procedures on a vehicle or engine from a 50-state engine family for use nationwide, or for a conversion system installed and tested under the above procedures on a vehicle or engine from a California engine family for use in California only

- 3) Until December 31, 1998, the use of an alternative fuel conversion system designed, tested, and installed on a single engine family, or multiple engine families (providing certain conditions are met) if testing is complete by March 31, 1998.

The addendum details the conditions required by Option 3. In general terms, Option 3 allows, for a limited time, manufacturers to establish a reasonable basis by performing specific emissions testing and demonstrating that the test vehicle or engine conforms with emissions standards after conversion.

Copies of the EPA policy are available from the EPA's Mobile Source Enforcement Branch at 202-564-2255 or on the EPA Office of Mobile Sources Web site. Refer to Appendix C (Informative Web Sites) and Appendix J (Contacts) in this guide for addresses.

An Example of Determining the Duration of a Certificate of Conformity

In the following example, the term “model year” refers to the model year of the certified aftermarket conversion, not the vehicle’s original model year. EPA Certificates of Conformity are good for one model year, which must always include January 1 of the calendar year for which it is designated and may not include January 1 of any other calendar year. The maximum duration of a model year is one calendar year plus 364 days. The certificate has an effective date on which conversions may begin, and they must stop no later than December 31 of the model year. If your company were issued a 1998 model year certificate with an effective date of September 26, 1997, you could start conversions on the effective date and convert vehicles through to December 31, 1998.

To take advantage of the maximum period for converting vehicles, your company would try to have the certificate issued with an effective date of January 2 of the year prior to the model year. For example, a 1998 model year certificate could be issued with an effective date of January 2, 1997, so that conversions could be done from January 2, 1997 through to December 31 of 1998 (one calendar year plus 364 days).

What Does Certification Apply To?

The EPA certification procedures give manufacturers a method to follow for certifying light-duty vehicles and trucks, as well as heavy-duty engines, to operate on CNG or LPG, either in dedicated or dual-fuel modes. Manufacturers that successfully complete the process receive a “Certificate of Conformity” from the EPA. With this certificate, manufacturers may convert the engine family or vehicle referenced in the certificate. Further, they become exempt from the tampering provisions under the CAA for the duration specified, as long as the vehicles are converted in the exact manner in which they were certified.

Each Certificate of Conformity applies to a specific engine family (see sidebar on page 9). The manufacturer or installer may only convert vehicles in the engine family named on the certificate. The certificate is valid for a single model year, and it lists the period during which vehicles from the specified engine family may be converted. The sidebar on this page contains an example of how these dates are established and applied.

There are three basic federal emissions certifications: (1) the so-called “49-state” certification, under which vehicles can be certified for operations in all states except California; (2) “50-state” certification, under which vehicles can be certified for operations throughout the country (vehicles issued a “50-state” certification and scheduled to be operated in California must also be certified by CARB); and (3) “California-only” certification, under which vehicles can be certified for operation in California only. California-only vehicles must first go through the CARB certification. This provision applies to OEM vehicles and to aftermarket conversions.

Engine Family Names Explained

For the purposes of emissions certification, and for ease in identification, the EPA classifies vehicles and engines with a standardized 12-character code known as an engine family name. Engines are grouped into families based on criteria provided in 40 CFR Part 86 (see 86.096-24), and the EPA's Advisory Circular No. 20-B, dated June 27, 1974 ("Determination of Engine Families and Classification of Emission Control Systems"). Changes in the format are scheduled to take effect for the 1998 model year. Although briefly outlined below, more information on the changes is available on the EPA's Office of Mobile Sources' World Wide Web site (see Appendix C, Informative Web Sites, for EPA Standardized Engine and Evaporative Family Names).

1997 and Earlier Model Years

The engine family name contains a wealth of information about a given vehicle or engine, including:

- The vehicle or engine model year
- Manufacturer
- Engine displacement
- Vehicle or engine class (for example, light-duty vehicle or heavy-duty engine)
- Fuel system (such as valves per cylinder, carburetor, or fuel injection)
- Combustion cycle (such as Otto or diesel) and fuel
- Applicable emissions standards
- Exhaust gas aftertreatment device (for example, a catalyst or a particulate trap)
- Whether on-board diagnostics (OBD) regulations apply.

VFM4.628GKEK is an example of a 1997 engine family code for a 1997 (V); Ford Motor Company (FM); 4.6 liter engine (4.6); in a light light-duty truck with a loaded vehicle weight between 3,751 and 5,750 pounds (2); equipped with electronic multi-point fuel injection and two valves per cylinder (8). It is an Otto-Cycle piston gasoline engine (G); certified to tier 1 emissions standards (K); with a three-way catalyst (E); and complies with federal OBD or California OBD II requirements (K).

Beginning with the 1998 Model Year . . .

The engine family name format has changed, although it still contains 12 characters. The first character is the model year, the second through fourth are the code for the manufacturer, the fifth is the family type (for example, light-duty vehicle, light-duty truck, heavy-duty engine), the sixth through ninth are displacement in liters, and the tenth through twelfth are reserved for the manufacturer's own use. WG9XT05.46BF is an example of a 1998 engine family code—the W signifies 1998 model year; the G9X signifies GFI Control Systems, Inc.; the T signifies light-duty truck family; the 05.4 signifies 5.4 liters; and the 6BF is a code defined by the manufacturer. Much of the information contained in the 1997 and earlier engine family names for light-duty vehicles and trucks is now included in the vehicle emission configuration bar code label (or format), which is part of the emissions control information label.

Small Volume Manufacturer Status and Its Benefits

A small volume manufacturer is defined as a company that will sell or convert fewer than 10,000 vehicles or engines during the model year in question. The company must apply to the EPA for this status. If the company qualifies under the specific terms that the EPA outlines, options for developing DFs may prove beneficial (see the discussion beginning on page 20 for more information about DFs).

A small volume manufacturer may qualify for a partial waiver of the certification fees, and may also qualify for a delay in the initial years of the phase-in schedules for certain emissions regulations. Refer to 40 CFR Part 86.085-1(e) for the criteria used to qualify companies as small volume manufacturers and to 40 CFR Part 86.098-14 for the 1998 model year certification procedures applicable to small volume manufacturers.

Overview of the Certification Process

Figure 1 illustrates the steps necessary for obtaining EPA certification. The process outlined here applies to small volume manufacturers of aftermarket conversions (the sidebar on this page explains small volume manufacturer status). The process includes applying to EPA for small volume manufacturer status, paying fees, conducting durability and emissions testing, comparing the test results with applicable emissions standards, applying for certification, and obtaining the Certificate of Conformity.

The EPA furnishes an information package to companies interested in certification using the small volume manufacturer rules. The information package contains reference materials about the certification process, the criteria companies must use to qualify as small volume manufacturers, instructions on applying for small volume manufacturer status, and other details such as the application fees.

After receiving the EPA information package, each company must decide whether it is interested, and determine whether it qualifies for small volume

manufacturer status. If the answer to both questions is “yes,” the next step is to send a written request for the status to the EPA. The written request must include responses to the list of questions contained in the information package. If the request is granted, the EPA will issue a manufacturer’s identification code. Next, the company must submit the application fees (see the section on page 13 entitled “Fees,” along with Table 2 on page 12).

The company must then determine the process it wants to use to establish deterioration factors (DFs). DFs are used to predict the increase in vehicle emissions associated with increased mileage accumulation (see the example contained in the discussion and sidebar on page 20).

After establishing the process for determining DFs, emissions testing can begin (see 40 CFR Part 86.094-14(c)). For light-duty vehicles and trucks, the EPA may decide to undertake additional testing of its own to verify emissions results. The manufacturer may be required to provide a prepared vehicle to the EPA for this testing. More information about emissions testing is provided in the section of this guide beginning on page 18. Once all the test results are gathered, the company submits an application for certification to the EPA for its review.

Submitting an Application

Submitting an application is really the final step in the process of obtaining emissions certification of a vehicle from the EPA. The application represents the culmination of considerable information gathering, and formally presents that information in such a way as to facilitate the EPA’s review and acceptance. To shorten the review process and to guarantee the speediest response time, the EPA suggests submitting the application in the format outlined in its information package. Following the EPA’s directions and providing the exact information requested will result in the quickest turnaround.

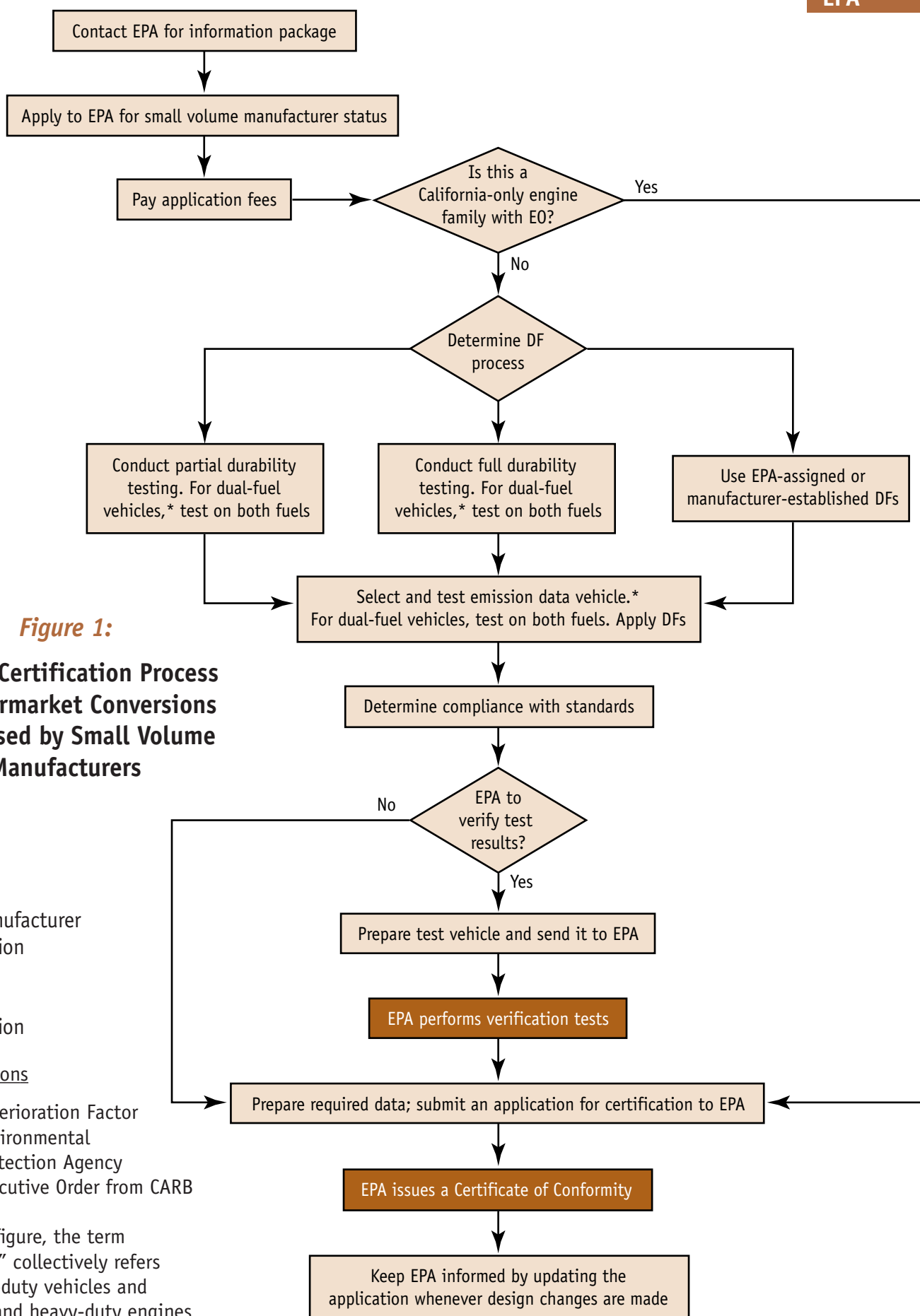


Table 2

EPA Certification Fees		
Vehicle or Engine Type	Certification Type	Fee Per Certification
Light-Duty Vehicle or Truck	Federal	\$23,731
	California Only	\$9,127
Heavy-Duty Vehicle or Engine	Federal	\$12,584
	California Only	\$2,145

For light-duty vehicles and trucks, the information that must be submitted with the application package includes:

- Pertinent company information, along with the name of the contact person
- A brief description of the vehicles to be certified, including:
 - Engine family name and vehicle models
 - List of parts to be added, removed, and modified
 - Conversion equipment description
 - Engine details
 - Emissions control system details
 - Engine calibration information
 - Durability information
- All emissions test results, and information about the facility that performed the tests
- Emissions standards with which the vehicle complies
- Appropriate signatures ensuring that the regulations have been met
- Examples of the emissions control labels, as well as examples of the ILEV decals if the certification is to meet ILEV standards (see the discussion on page 23 of this guide)
- Maintenance instructions
- Emissions warranty statements (see the discussion on page 24 of this guide)
- Statement of compliance.

To certify vehicles to the CFF Program (see 40 CFR Part 88), the application must also include the name of the installer(s) who will complete the conversions if the installer(s) is different from the holder of the certificate.

The application for heavy-duty engines is similar, but is currently under review as a result of an effort to reduce the level of reporting. Contact the EPA Office of Mobile Sources, Engine Compliance Programs, listed in Appendix J, and ask for the U.S. EPA Large Engine and Evaporative Certification Guidance document.

EPA Review and Issuance of a Certificate of Conformity

Upon receiving an application, the EPA begins its review process. If the review is positive, a Certificate of Conformity is issued. If all the required information is submitted with the application, the turn-around time for issuing the certificate is relatively short. However, for a light-duty vehicle or truck, the EPA may request a test vehicle for verification purposes. If the EPA does not request one, the turnaround time is approximately one month. If the EPA does request an emissions test vehicle, and it is made available to the EPA as soon as it is requested, the turnaround time will be approximately two additional weeks from the time the test vehicle arrives at the EPA test facility. This vehicle must already be prepped and have the required minimum mileage (minimum of 2,000 miles) on the alternative fuel system and on the stabilized emissions control system.

Table 3

Index to Locating Emissions Standards in Title 40, Part 86 of the <i>Code of Federal Regulations</i> (CFR)									
	1991 & Later	1993 & Later	1994 & Later	1996 & Later	1997 & Later	1998 & Later	1999 & Later	2001 & Later	2004 & Later
Light-Duty Vehicle	86.090-8	86.090-8	86.094-8	86.096-8	86.096-8	86.098-8	86.099-8	86.099-8	86.099-8
Light-Duty Truck	86.091-9	86.091-9	86.094-9	86.096-9	86.097-9	86.097-9	86.099-9	86.001-9	86.004-9
Heavy-Duty Otto-Cycle Engine	86.091-10	86.091-10	86.091-10	86.096-10	86.096-10	86.098-10	86.099-10	86.099-10	86.099-10
Heavy-Duty Diesel Engine	86.091-11	86.093-11	86.094-11	86.096-11	86.096-11	86.098-11	86.099-11	86.099-11	86.099-11

Table 4

Index to Locating Clean-Fuel Vehicle Emissions Standards in Title 40, Part 88 of the <i>Code of Federal Regulations</i> (CFR)			
	1994 & Later (LEV ^a , ULEV ^b , & ILEV ^c)	1993 & Later (ILEV ^c)	1998 & Later (ILEV ^c)
Light-Duty Vehicle	88.104-94	88.311-93	88.311-98
Light-Duty Truck	88.104-94	88.311-93	88.311-98
Heavy-Duty Otto-Cycle Engine	88.105-94	88.311-93	88.311-98
Heavy-Duty Diesel Engine	88.105-94	88.311-93	88.311-98

^a Low-Emission Vehicle^b Ultra Low-Emission Vehicle^c Inherently Low-Emission Vehicle

Fees

The EPA charges a fee for each engine family certification request; Table 2 contains examples of these fees.

Small volume manufacturers must either pay the predetermined fee or apply for a partial waiver. The waiver must be requested prior to payment of any fee because it provides only an alternative method of fee calculation. For aftermarket conversions, the alternative fee is based on 1% of the total value of all vehicles to be converted. This includes both the value of the vehicle and the value of the conversion kit. Vehicle value is determined using the National Automobile Dealer's Association (NADA) price guide or other evidence of the actual market value if the vehicle is not included in the NADA price

guide. A request for the waiver should be submitted at the same time as the request for small volume manufacturer status.

Applications that do not result in a certification are eligible for a partial refund.

Emissions Certification Standards

Emissions standards are found in various sections of the CFR. Tables 3 and 4 summarize the locations by model year and vehicle or engine type. In addition, Appendix D summarizes the exhaust emissions standards.

Vehicles or engines that are converted to dual-fuel operation must be tested on and meet the emissions standards for both fuels. The standards are fuel-specific. Exhaust emissions standards for LPG

Example of Applying Standards and Test Procedures for CFV Dual-Fuel Aftermarket Conversions

Suppose a manufacturer requests a 1998 model year certification for a light-duty truck that it has converted to a CNG/gasoline dual-fuel vehicle, and wishes to certify to the LEV standard. Before the conversion, the original model year of the truck was 1996, and it was originally certified on gasoline. To certify it as a dual-fuel vehicle for the 1998 model year, the manufacturer must perform emissions tests on CNG using the 1998 emissions test procedures for CNG, apply the DFs, and compare the results to the LEV certification standards.

In addition, the vehicle must be tested on gasoline after conversion using the 1996 test procedures, the 1996 gasoline standards and the CFV NMOG and formaldehyde standards for gasoline. Testing on gasoline must include all of the 1996 test procedures—cold temperature carbon monoxide (CO), certification short test, evaporative, and spitback. Manufacturers do not need to comply with the new OBD requirements if they can provide a written technical justification. OBD requirements are explained on page 22 of this guide.

vehicles are identical to those for gasoline vehicles. The standards for CNG vehicles are also identical to the gasoline standards, except for hydrocarbons. The certification standards for hydrocarbon emissions from CNG vehicles are specified in terms of non-methane hydrocarbons instead of total hydrocarbons. CFV standards include a non-methane organic gas (NMOG) standard.

Manufacturers who are certifying a vehicle to tier 1 standards (see sidebar on page 17) must meet the tier 1 standards that were in place for the model year in which the vehicle was originally certified. This applies to dedicated and dual-fuel vehicles. Dual-fuel vehicles must be tested on and meet the applicable standards for both fuels. Manufacturers certifying to the CFV standards must meet the standard that applies to the alternative fuel for the model year for which certification is being requested. In other words, a 1996 model year vehicle converted and being certified to CFV standards in 1998 must meet the 1998 emissions standards. Dual-fuel vehicles being certified to meet CFV standards must also satisfy a NMOG and formaldehyde standard on the conventional fuel. They must also comply with the other conventional fuel standards that were in effect when the vehicle received its original certification. Dual-fuel vehicles cannot be certified to the ILEV standard. The sidebar on this page gives an example of applying emissions standards for CFVs.

EPA's emissions certification standards vary with vehicle type and weight. For example, there are specific standards for light-duty vehicles and trucks, which can weigh up to 8,500 pounds gross vehicle weight rating (GVWR). Such vehicles are tested using a chassis dynamometer following the applicable light-duty test



Warren Gretz, NREL/PIX 05113

Emissions test on an aftermarket conversion being performed on the Colorado Department of Health and Environment's chassis dynamometer

Table 5

Weight Groupings for Light-Duty Trucks

Vehicle Type	Weight Class	GVWR ^a	LVW ^b or ALVW ^c
Light Light-Duty Truck	1	0–6,000 lb	0–3,750 lb LVW
Light Light-Duty Truck	2	0–6,000 lb	3,751–5,750 lb LVW
Heavy Light-Duty Truck	3	6,000–8,500 lb	3,751–5,750 lb ALVW
Heavy Light-Duty Truck	4	6,000–8,500 lb	Greater than 5,750 lb ALVW

^a Gross Vehicle Weight Rating^b Loaded Vehicle Weight^c Adjusted Loaded Vehicle Weight

Table 6

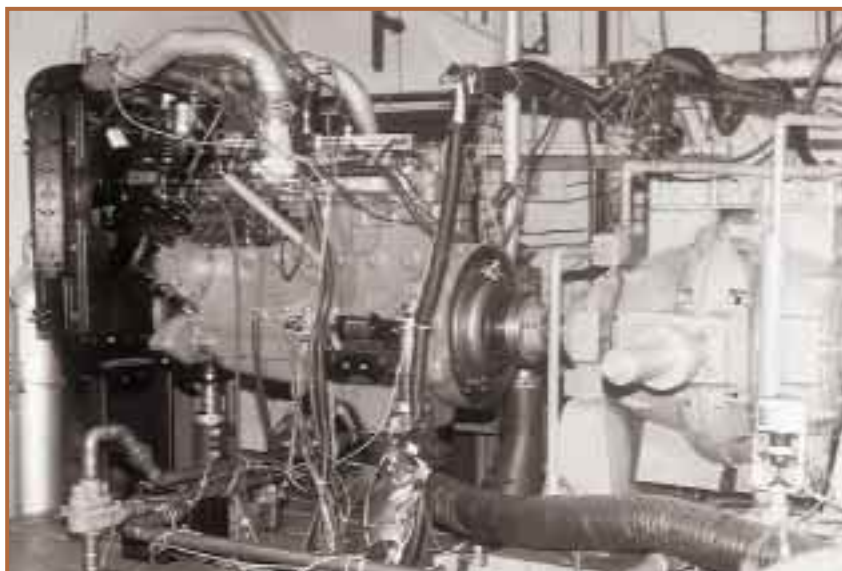
Heavy-Duty Engine Classifications

Engine Type	Typical Vehicle GVWR ^a	Typical Horsepower Range
Light Heavy-Duty Engine	8,501–19,499 lb	70 to 170
Medium Heavy-Duty Engine	19,500 lb–33,000 lb	170 to 250
Heavy Heavy-Duty Engine	33,001 lb and greater	Greater than 250

^a Gross Vehicle Weight Rating

procedures. For these tests, exhaust emissions are measured in grams per mile. Light-duty trucks are further divided into subgroups according to weight (see Table 5). The tier 0 emissions category has two subgroups, tier 1 has four, and CFV has five.

Vehicles that weigh more than 8,500 pounds GVWR are classified as heavy-duty, and different test procedures and standards apply. Instead of testing the vehicle on a chassis dynamometer, the engine is tested separately using an engine dynamometer. Exhaust emissions are measured in grams per brake horsepower-hour. Refer to Table 6 for a description of the heavy-duty engine classifications. Vehicles that weigh between 8,501 and 10,000 pounds GVWR can either be tested on a chassis dynamometer as heavy light-duty trucks or their engines can be tested as heavy-duty engines (see 40 CFR Part 86.094-1(b)).



Navistar 466 diesel engine converted to natural gas, being tested on an engine dynamometer

Table 7

Time and Mileage Limits^a for Determining the Tier 1 Standards Applicable to Intermediate and Full Useful Life Exhaust and Evaporative Emissions

Vehicle/Engine Type	Useful Life for Exhaust Emissions		Useful Life for Evaporative Emissions
	Intermediate	Full	Full
Light-Duty Vehicle	5 years or 50,000 miles	10 years or 100,000 miles	10 years or 100,000 miles
Light-Duty Truck 1 & 2	5 years or 50,000 miles	10 years or 100,000 miles	10 years or 100,000 miles
Light-Duty Truck 3 & 4	5 years or 50,000 miles	11 years or 120,000 miles	11 years or 120,000 miles
Heavy-Duty Otto-Cycle Engine	none	8 years or 110,000 miles	10 years or 110,000 miles
Light Heavy-Duty Diesel Engine	none	8 years or 110,000 miles	8 years or 110,000 miles
Medium Heavy-Duty Diesel Engine	none	8 years or 185,000 miles	8 years or 185,000 miles
Heavy Heavy-Duty Diesel Engine	none	8 years or 290,000 miles	8 years or 290,000 miles

^a Time and mileage are expressed in years and miles, and are one or the other, whichever comes first

For light-duty vehicles and trucks, the EPA also assigns different emissions standards on the basis of years or miles in service. These are known as intermediate and full useful life standards (see “Terms” in Appendix A for a definition of useful life), and Table 7 specifies the time and mileage limits that apply. The standards for full useful life are less stringent than those for intermediate useful life to account for the wear and tear on components resulting from normal use. In other words, emissions performance is expected to deteriorate over time. Compliance with both the intermediate and full useful life standards is determined by applying the appropriate DFs to the emissions test results (more information about DFs is found on page 20 of this guide). Compliance with tier 0 emissions standards is required only at 50,000 miles. Emissions test results after factoring in the DFs are to be within the values set for each period.

The useful life period of a vehicle does not change as the result of conversion. For example, if a light light-duty truck has 10,000 miles on its odometer at the time of conversion, its full useful life will end once its odometer reaches 100,000 miles (not 110,000 miles).

In addition to testing for exhaust emissions, a number of other tests must also be performed as part of the EPA Federal Test Procedures (FTP) for emissions certification. These may include multi-day measurement of evaporative emissions and on-board vapor recovery, as well as the spitback, refueling, cold temperature CO, idle, and certification short tests (see CFR 40 Part 86 for details). Results from each test must be compared to the corresponding certification standards.

Some of the EPA’s regulations that govern emissions standards are being phased in over time, and others will not become effective for a number of years. As previously noted, small volume manufacturers are exempt from the initial years of the phase-in of the regulations.

Evolving Emissions Standards

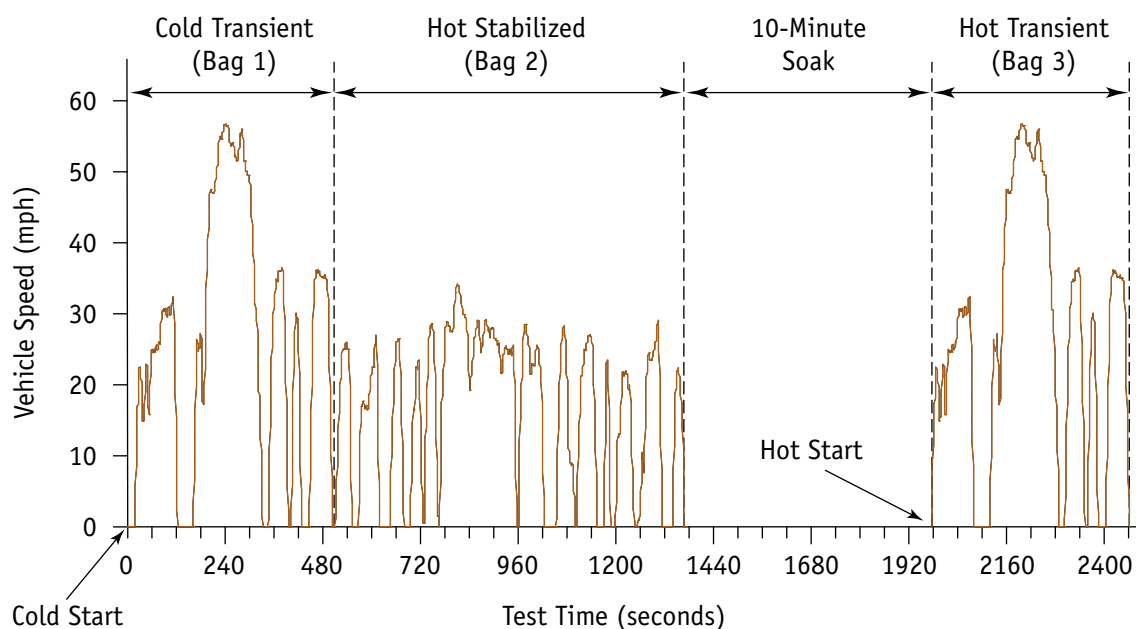
Emissions standards have been undergoing continuous change for a number of years—a trend that is expected to continue. This trend is driven by the need for improvements in air quality, changes in vehicle emissions control technology and, of course, changes in the fuels themselves.

The EPA and CARB use various names and abbreviations to refer to the various emissions standards. The EPA currently uses tier 0, tier 1, TLEV, LEV, ILEV, ULEV, and ZEV. These standards are ranked from less stringent to more stringent (for example, tier 1 is a more stringent emissions standard than tier 0, and ZEV is the most stringent). The term TLEV applies to California vehicles only. CARB does not have an ILEV standard, but it does have a super-ultra-low-emission vehicle (SULEV) standard for medium-duty vehicles. SULEV is even more stringent than the ULEV standard. Although the name of a standard may be used for many vehicle types, the actual value can be different for each vehicle type. For example, the federal tier 1 standards for light-duty vehicles are more stringent than the federal tier 1 standards for light-duty trucks. EPA and CARB emission standards may differ for the same vehicle type even though they may be described by the same name.

The EPA has implemented the LEV, ILEV, ULEV, and ZEV standards under the CFF Program to address air quality issues in cities that do not comply with federal air quality standards. Although vehicles that meet those standards can be used elsewhere, fleets within cities that do not meet the air standards are mandated to phase in purchases of new vehicles that comply with LEV and ULEV standards. Vehicle manufacturers certifying vehicles for sale in California are required to phase in sales of TLEV, LEV, ULEV, and ZEV vehicles.

Appendix A presents additional details on the names and abbreviations of various standards, and Appendix D summarizes each of the standards by vehicle type.

Figure 2:
FTP-75 Using the Urban Dynamometer Driving Schedule



Emissions Testing

Emissions testing is perhaps the most time-consuming and costly part of the certification process, but it is also the most important. We encourage you to become as familiar with the details of emissions testing as possible.

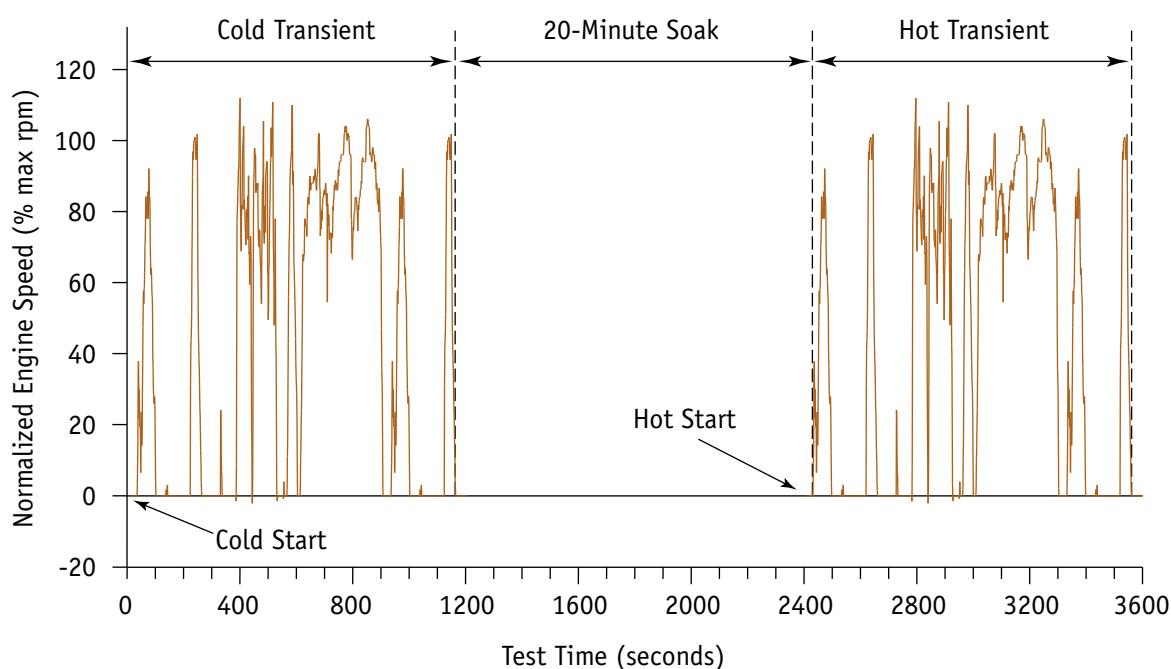
Exhaust and Evaporative Testing Procedures

The procedures that the EPA specifies for emissions testing of light-duty vehicles and trucks are contained in 40 CFR Part 86, Subpart B. The exhaust emissions test procedures follow the EPA FTP 75, which uses the urban dynamometer driving schedule (Figure 2). New multi-day procedures for enhanced evaporative emissions testing are being phased in. Although small volume manufacturers are exempt from the initial years of this phase-in, they must comply with the 100% requirement for the model year listed in the regulations.

Both the exhaust and evaporative testing procedures must be conducted in a specific sequence and in temperature-controlled environments. Several steps in the evaporative testing procedures for gaseous fuels differ from those required for gasoline. For example, different fuel tank levels are involved, and the supplemental two-day diurnal test and the refueling spitback test are not required for CNG and LPG. If the vehicle is dual-fuel, it must be tested on both fuels, including all the test procedures normally required for gasoline systems.

The exhaust and evaporative emissions test procedures for heavy-duty engines are contained in a number of different subparts of 40 CFR Part 86 (see Table 8). Heavy-duty engines are tested on an engine dynamometer using the transient engine dynamometer test cycle (Figure 3).

Figure 3:
Transient Engine Dynamometer Test Cycle



Testing Facilities

The EPA does not certify or approve emissions laboratories or test facilities, but it does maintain a list of organizations with which it has worked on emissions-related projects. Without making any endorsements or recommendations, the EPA makes this list of test facilities available on its site on the World Wide Web (see Appendix C). Because a number of new tests, such as the enhanced evaporative and the cold CO protocols, require extensive equipment and facilities, be sure to secure the services of a testing facility that maintains the appropriate equipment if such tests are required.

Test Fuels

The EPA provides specifications for the conventional fuels, as well as for CNG and LPG, to be used in emissions testing (see 40 CFR Part 86.113-94). Appendix E presents details on the specifications of the CNG to be used in exhaust and evaporative emissions testing. Because this is a special blend, allow adequate time in your

testing schedule for the laboratory to obtain an ample supply. Commercial-grade fuel is suitable for in-service mileage accumulation. Commercial-grade LPG is acceptable for exhaust and evaporative testing, and for in-service mileage accumulation. The formulation of the CNG and LPG to be used in a testing protocol must be submitted as part of the certification application.

Table 8

Index for Locating Heavy-Duty Engine Test Procedures in Title 40, Part 86 of the *Code of Federal Regulations* (CFR)

Test Procedure	Subpart
Gaseous Exhaust	N
Smoke Exhaust	I
Evaporative	M
Particulates	N
Idle	P
Altitude	Q

Example of Applying Deterioration Factors

Assume the manufacturer has decided to use EPA-assigned DFs for a dedicated light-duty LPG vehicle (Enclosure 5 of the EPA Manufacturer's Guidance Letter CD-95-14 provides the assigned DFs used in this example). The manufacturer completes the baseline testing at 2,000 miles and is given results for the various regulated exhaust emissions components. These results are then multiplied by the intermediate and full useful life DFs for each component. The calculated values are then compared to the intermediate and full useful life standards. If all the components are simultaneously below the values in the standard, the vehicle is in compliance. If any value exceeds its expected limit, the vehicle is not in compliance. See Appendix A for an explanation of all abbreviations.

Mileage	Item	Exhaust Emissions, in grams/mile				
		THC	NMHC	CO	NO _x	PM
2,000 miles	Test Results	0.15	0.12	1.8	0.19	0.01
50,000 miles	Assigned DFs	1.7	1.6	1.6	2.0	1.3
	Calculated Results	0.26	0.19	2.9	0.38	0.01
	Tier 1 Standard	0.41	0.25	3.4	0.4	0.08
100,000 miles	Assigned DFs	N/A ^a	1.9	1.9	2.3	1.3
	Calculated Results	N/A ^a	0.23	3.4	0.44	0.01
	Tier 1 Standard	N/A ^a	0.31	4.2	0.6	0.10

^a N/A = "not applicable"

Deterioration Factors

Because the performance of emissions control systems is expected to decline (i.e., vehicle emissions will increase) with mileage or hours of service, compliance with the EPA emissions standards is based on applying DFs to the base emissions test results. DFs are used to predict this expected increase in vehicle emissions at the useful life mileage points. Refer to EPA Manufacturer's Guidance Letter CD-95-14 and Advisory Circular A/C No. 51C for direction on whether the DF is multiplied or added to the baseline emission test results.

DFs are typically determined by the manufacturers through tightly controlled test procedures during which mileage or hours of service are accumulated and emissions tests are performed. For light-duty vehicles, the emissions standards are specified in terms of emissions limits to be met at the full or intermediate useful life. For instance, 1996 model year light-duty vehicles have one set of emissions standards to be met at the intermediate useful life (defined as five years or 50,000 miles) and another at the full useful life (ten years or 100,000 miles). The vehicle must comply with both sets of emissions standards.

Compliance with heavy-duty engine standards is determined in much the same way. The base emissions measured on a new engine must be adjusted using the appropriate DFs before comparing the results to the emissions standards.

If the manufacturer qualifies for small volume manufacturer status (see the sidebar on page 11), some benefits can be realized from determining and assigning DFs for gaseous fueled vehicles and engines. The details are explained in 40 CFR 86.096.14 and Manufacturer's Guidance Letter CD-95-14. The available options are:

- Complete durability testing for the intermediate and full useful life of the vehicle
- An abbreviated durability test covering 25,000 miles, with more frequent emissions testing
- Using the EPA's assigned DFs or the DFs already established by the manufacturer from previous testing.

The EPA retains the right to rescind the use of its assigned DFs if subsequent testing indicates that emissions levels are higher than anticipated. Regardless of how the DFs are determined, they are subsequently applied to the baseline emissions test results of each vehicle to determine compliance with both its intermediate and full useful life emissions standards. The sidebar on page 20 gives an example of how DFs are applied to baseline emissions test results to determine compliance with the standards.

Mileage Accumulation Cycle

After converting the test vehicle to CNG or LPG, and before any emissions testing, each light-duty vehicle and truck must accumulate a minimum of 2,000 miles on its odometer. For heavy-duty

engines, a minimum of 62 hours of operation must be accumulated. These vehicles or engines are known as emission data vehicles (EDVs) or engines.

For manufacturers of light-duty vehicles and trucks who choose to generate their own DFs by conducting durability testing, two methods may be applied to accumulate the required mileage.

The first method is specified in 40 CFR Part 86, Appendix IV ("Durability Driving Schedule"). Under this protocol, a vehicle is driven on a 3.7-mile course at various speeds (up to 70 miles per hour) for a specified period of time. The vehicles tested are referred to as durability data vehicles (DDVs). The second method, which requires prior approval from the EPA, is outlined in EPA Advisory Circular No. 37-A. Under this protocol, mileage can be accumulated on test tracks, dynamometers, or public roads as long as the mileage accumulation meets the criteria contained within No. 37-A. The maximum speed is 55 miles per hour over a 3.7-mile cycle.

Maintenance Schedule during Testing and Data Collection

EPA regulations specify the minimum maintenance interval for emissions control components. This schedule also applies to any maintenance performed during the mileage accumulation phase of durability testing. This information is contained in the EPA's information package and in 40 CFR 86.094-25. Maintenance may not be performed more frequently than specified in the regulations or the manufacturer's maintenance schedule.

Table 9

Required Number of Emissions Tests (FTP 75) for Dedicated Alternative Fuel Vehicles		
Option for Determining Deterioration Factors (DFs)	On the Durability Data Vehicle	On the Emission Data Vehicle
Full mileage accumulation	Minimum of 2 ^a	1
Abbreviated mileage accumulation	5 required, 6 optional	1
Manufacturer's own DF (previous history)	0	1
EPA-assigned DF	0	1

^a A minimum of two are required, but additional tests equally spaced in mileage are encouraged in order to confirm the DF. Six or seven tests would provide a more meaningful and reliable representation of this value.

Required Number of Tests for Light-Duty Vehicles and Trucks

The required number of emissions tests varies depending on which option is chosen to develop DFs. It is necessary to use only one DDV per engine family to establish the DFs and one EDV per engine family to measure emissions levels. The DFs are applied to the results of the EDV and are used to calculate the intermediate and full useful life values. Results of all tests must be supplied to the EPA. Table 9 outlines the required number of tests for various situations for dedicated CNG and LPG vehicles. For dual-fuel vehicles, the number of tests shown in Table 9 must be doubled. Because emissions test results are known to be variable depending on the vehicle being tested, it is wise to conduct more tests than the minimum number required to confirm the results.

Carry-Across and Carry-Over

"Carry-across" is the term used for applying emissions results generated for one engine family to another family from the same model year. Similarly, "carry-over" is the term used for applying emissions results from an engine family in one year to an engine family in the succeeding model year. EPA Advisory Circular No. 17F sheds more light on these concepts. The circular explains the EPA's position on the suitability of carrying results from

test vehicles and durability data vehicles, as well as fuel economy, to other models in the same or later years. DFs are carried over more frequently than the baseline emissions test results.

Corporate Average Fuel Economy (CAFE) Testing and the Gas Guzzler Tax

Only new light-duty vehicles and trucks are subject to CAFE, fuel economy labeling, and the "gas guzzler" tax. Aftermarket conversions need not comply with these regulations.

On-Board Diagnostics (OBD)

The EPA has established regulations governing OBD systems for light-duty vehicles and trucks. These regulations require that certain components in the emissions control system be monitored for proper performance over the vehicle's lifetime. Typically, the vehicle's electronic control unit (ECU) is programmed to monitor the function of specific emissions control systems through signals it receives from various engine control sensors and actuators, such as the exhaust gas oxygen sensor. When unacceptable deterioration or malfunctions occur, a diagnostic trouble code is stored in the ECU, and a message light is illuminated on the vehicle's dashboard (for example, "Service Engine Soon" or "Check Engine"). These systems were

originally designed by the vehicle manufacturers to detect and diagnose problems when electronic control systems replaced mechanical systems. The EPA now requires light-duty vehicles and trucks to be equipped with such systems in order to help reduce emissions caused by malfunctioning emissions controls.

The latest OBD requirements, known as federal OBD regulations, are virtually the same as California's OBD II regulations. All light-duty vehicles and trucks produced during and after the 1996 model year must meet these regulations. Federal OBD regulations require that virtually all the vehicle's emissions control system components be monitored, including catalyst efficiency, engine misfires, closed loop fuel system performance, oxygen sensor performance, and exhaust gas recirculation. Currently, CNG and LPG vehicles can receive justifiable waivers from the federal OBD requirements up to and including the 1998 model year. Even with this waiver, the OBD system must remain intact while the vehicle is operating on gasoline. Under an EPA notice of proposed rule-making published in May 1997, the EPA is proposing to extend the justifiable waivers. Here is an excerpt from the notice:

"EPA is proposing to extend the current flexibility provisions for alternative fuel vehicles through the 2004 model year. Such vehicles will be expected to comply fully with the OBD requirements during gasoline operation (if applicable), and during alternative fuel operation except where it is technologically infeasible to do so. Any manufacturer wishing to utilize this flexibility provision must demonstrate technological infeasibility concerns to EPA well in advance of certification application."

Labels, Decals, and Maintenance Schedule

After it has been converted, each vehicle or engine must display a supplemental emissions control label. This label must be placed adjacent to the original emissions control information label. The specific requirements governing the appearance and placement of the label are contained in 40 CFR Part 85.505. The new label must indicate that the vehicle has been converted to operate on an alternative fuel; it must specify the equipment manufacturer's and the installer's names, addresses, and telephone numbers; and it must present all conversion-related details, such as the model year, date of conversion, mileage at conversion, and changes made to the vehicle (for example, tuneup specifications).

Additional labeling requirements for CFF vehicles are found in 40 CFR Part 88. Part 88 requires that the label in Part 86 also stipulate whether the vehicle or engine in question is LEV- or ULEV-compliant and meets all the requirements of Part 88.

Heavy-duty vehicles, as defined in Part 88, are also required to display a label (see 40 CFR 88.305-94) if they are not covered by the requirements specified in Part 86.

Providing that certain criteria are met, vehicles that are ILEV-compliant may be able to take advantage of transportation control measure exemptions such as using high-occupancy vehicle (HOV) lanes. An example of such criteria is the requirement to mount special decals on the exterior of the vehicle.

Samples of these labels and decals must be submitted to the EPA before a Certificate of Conformity can be issued.

In addition to providing vehicle labels and decals, manufacturers are to provide vehicle owners with the maintenance schedule for emissions-related items (see 40 CFR Part 86.094-25(b)(1)).

Record Keeping

Manufacturers are required to keep detailed certification information for a period of eight years from the date on which the Certificate of Conformity is issued. Manufacturers must also keep detailed records of the number of such vehicles that are converted (i.e., the number of conversion kits that are sold), but the eight-year period starts at the end of the model year. The EPA's requirements for record retention are outlined in 40 CFR Parts 86.094-7 and 86.096-7. All such information must be made available to the EPA on request.

Manufacturers are further responsible for maintaining conversion records on vehicles converted under the CFF Program (see 40 CFR Part 88.306-94 (f)). These records, which must include the following information, must be kept for a period of five years from the date of conversion.

- Engine or vehicle make, model, model year, and vehicle identification number (VIN)
- Certification number of the conversion configuration
- Brand name and numbers of parts used in the conversion
- Date of the conversion
- Facility where the conversion equipment was installed
- Results of post-conversion emissions testing.

Warranty

The EPA's regulations require that manufacturers provide both an emissions design and defect warranty and an emissions performance warranty for light-duty vehicles and trucks. Effective with the 1995 model year, the warranty period is two years or 24,000 miles, whichever comes first. For EPA-specified major emissions control components such as the catalytic converter, the electronic emissions control unit, and an on-board emissions diagnostic device, the warranty period is eight years or 80,000 miles, whichever comes first.

For heavy-duty Otto-Cycle engines and light heavy-duty diesel engines, manufacturers must provide a design and defect warranty of five years or 50,000 miles, whichever comes first; for medium- and heavy heavy-duty diesel engines, five years or 100,000 miles, whichever comes first. If the manufacturer provides a longer period on the basic mechanical warranty to the engine family, this period must also extend to the emissions warranty.

The warranty must cover the labor to diagnose and repair or replace the part as well as the cost of any replacement parts. The certification application for light-duty vehicles and trucks must contain the provisions of the warranty policy to be offered.

It is also important to note that the OEM continues to be responsible for those parts of the vehicle that retain their original function after conversion. In addition, the warranty period of an aftermarket conversion does not need to extend past that of the original vehicle or engine. For example, if a heavy-duty Otto-Cycle engine has 5,000 miles on its odometer at the time of conversion, its design and defect warranty period will end once its odometer reaches 50,000 miles (not 55,000 miles).

Audit and In-Use Surveillance

To ensure that conversion equipment is designed, built, and installed so as to allow vehicles to meet emissions standards throughout their useful lives, the EPA has established a number of compliance programs that it enforces as part of its emissions regulations. For example, during the certification process, the EPA may evaluate the emissions control design of all conversion equipment. It also conducts selective enforcement audits of product assembly lines and equipment installers, and it evaluates vehicles during in-use operations. Vehicles and engines can be recalled if the EPA determines that they are not meeting the useful life standards to which they have been certified.

Responsibilities of Distributors and Installers

The manufacturer of record on the Certificate of Conformity is responsible for ensuring that all vehicles being converted comply with the terms of the certificate. The manufacturer's interests will be best served by providing the installer with a detailed parts list, complete installation instructions, all examples of proposed labels and decals, vehicle maintenance schedules, post-conversion inspection and testing requirements/methods, information on record-keeping plans, and training for proper equipment installation.

Establishing a quality control program for the entire vehicle conversion process is also advisable. The installer must ensure that the vehicle being converted is of the same engine family as that for which the Certificate of Conformity has been granted. The installer must follow installation instructions exactly with no component substitutions.

Failure to install the conversion system on the correct engine family, installing the wrong parts, or improperly installing the correct parts may subject the manufacturer and/or the installer to a civil penalty of up to \$25,000 per vehicle or engine.

Certification under the CFF Program requires that the manufacturer provide installation instructions to the installer(s) (see 40 CFR Part 88.306-94). The manufacturer must also provide the name of the installer(s) to the EPA as part of the certification application. Only those installers listed on the application may perform conversions.

Vehicles and engines that are part of the CFF Program and are converted under the auspices of small volume manufacturer status must pass a post-conversion CO emissions test (see 40 CFR Part 88.306-94). There are two options for conducting the test: (1) for light-duty vehicles and trucks, follow the inspection and maintenance requirements and procedures applicable to the geographic area in which the vehicle will be operated; and (2) conduct a specific two-speed idle test, which must be conducted using certification fuel. Both methods require that dual-fuel vehicles be tested on each fuel.

Under certain conditions, fleet operators who are converting to an ILEV-compliant vehicle may be able to take advantage of transportation control measure exemptions such as using HOV lanes. First, fleets must verify that they are eligible for exemption from transportation control measures. If the fleet qualifies and wants to take advantage of the HOV lanes, the installer must also place three ILEV decals on the exterior of the vehicle to clearly signify ILEV status. Engines used in heavy-duty vehicles weighing more than 26,000 pounds may not qualify for this exemption.

Liabilities

Liabilities are incurred when all provisions of the CAA are not met. Section 205 (a) (see below) stipulates that penalties will be imposed on companies and individuals that do not comply with its provisions.

(a) Violations - any person who violates sections 203 (a) (1), 203 (a) (4), or 203 (a) (5) or any manufacturer or dealer who violates section 203 (a) (3) (A) shall be subject to a civil penalty of not more than \$25,000. Any person other than a manufacturer or dealer who violates section 203 (a) (3) (B) shall be subject to a civil penalty of not more than \$2,500. Any such violation with respect to paragraph (1), (3) (A), or (4) of section 203 (a) shall constitute a separate offense with respect to each motor vehicle or motor vehicle engine. Any such violation with respect to section 203 (a) (3) (B) shall constitute a separate offense with respect to each part or component. Any person who violates section 203 (a) (2) shall be subject to a civil penalty of not more than \$25,000 per day of violation.

If conversion equipment is being installed under the provisions of the addendum to Memo 1A (see page 7 of this guide) rather than a Certificate of Conformity, the installer must request and retain a representation from the manufacturer (or any party that takes on demonstration requirements in accordance with the addendum) that the conversion system meets the addendum's requirements for the specific engine family being converted. The installer should request installation instructions, which must be followed exactly with no component substitutions. The installer should also ensure the conversion equipment is being installed on vehicles of the same engine family on which testing was performed. The installer must retain records for each vehicle converted—the customer's name and address, the VIN, the make and model year of the vehicle, the date of installation, the installer, and the manufacturer's representation of conformance to the addendum. Retaining the vehicle's odometer reading at the time of

installation, the brand name(s) and part numbers of all equipment installed, and the calibration settings is also advisable.

Distributors should follow a similar process. If they did not perform the emissions testing, they should request and retain representation that the conversion system meets the addendum's requirements for the given engine family. They should also keep information on each conversion kit sold, the name of the purchaser, all part numbers, the date of sale, and the number of systems sold.

Clean-Fuel Vehicles and Mobile Emissions Reduction Credits

Under the provisions of the CAA, mobile emissions reduction credits may be granted for fuels and vehicles that meet the CFF Program requirements (see 40 CFR Part 88). To receive mobile emission reduction credits, the fleet must first exceed the minimum requirements of the CFF Program. This program applies to light-duty vehicles and trucks, heavy light-duty trucks, and heavy-duty engines that are certified to the LEV, ILEV, and ULEV standards. The original implementation date was model year 1998, but it has been recently postponed to model year 1999, although cities may opt in earlier.

Those cities that are in non-attainment with federal air quality standards, as outlined in the CAA, are eligible for the federal emissions reduction credits program. Fleets operating within these cities are required to purchase CFVs as stipulated in 40 CFR Part 88. Such vehicles must be certified to CFV emissions standards using the procedures outlined in 40 CFR Parts 86 and 88.

In addition to qualifying for credits, CFVs are also exempt from a number of transportation control measures (see 40 CFR Part 88.307-94) in non-attainment areas. For example, vehicles that are ILEV-compliant may qualify to use HOV lanes.